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The increasing difficulty of financing farms from current income is analyzed in the article "Changes in the Financing Needs of Illinois Farmers." The author presents trends in capital assets, cash expenses, and income for three types of farms. Several alternatives to the traditional methods of gaining control of the resources required in farming are discussed as possible consequences of the increased financing needs. Some of these alternatives would materially change the character of present-day farming.

Developments in the Japanese soybean market have important implications for Illinois producers. The second article in this issue describes the characteristics of the Japanese demand for soybeans. Predicted changes in the consumption of fats and oils, meat, and milk will tend to increase the demand for soybeans. The author suggests that production of soybeans in Japan will decrease, which, coupled with the prospective increase in demand, means an increase in the potential export market for U. S. soybeans.

One of the important elements in the milk market structure is the relationship of consumption to retail price. The third article in this issue presents a comprehensive review of the research on this relationship. In view of the probable widespread use of types of dairy products to be placed on the market in the near future, the conclusions of some of the recent studies reviewed have special importance to expansion of the market for fluid milk and cream.

Supermarkets and variety stores offer promise as outlets for increasing the sales of floricultural products, according to the author of "Floriculture Sales in Mass-Market Outlets." The author reports the results of a three-year experiment involving sales of potted plants and cut flowers in a supermarket, a variety store, and the conventional sales outlet — a floral shop. Nearly 12,000 plants and bunches were sold during the course of the experiment.

Year-to-year crop-acreage adjustments represent one of the components of the year-to-year changes in crop production. In the final article, the relative importance of these acreage changes on changes in production is analyzed. The strong competitive position of corn in Illinois crop production is demonstrated by the relationship between corn price and acres planted to corn under the assumption that acres may be shifted, within limits of past experience, from one crop to another on the basis of relative profitability of the crops.

ILLINOIS AGRICULTURAL ECONOMICS

Changes in the Financing Needs of Illinois Farmers

C. B. BAKER

IN THE PAST TWO DECADES dramatic changes have occurred in most of Illinois' agriculture. In all areas farms have been consolidated in the wake of unprecedented off-farm migration. For all types of farms there has been a vast substitution of capital assets and machine methods for labor and also, relatively speaking, for land. As a result, the total assets on Illinois farms as well as their structure have changed. To a remarkable degree much of the change has been financed by farmers from currently earned income. However, it is apparent that much of the increase in the equity of farmers is due to inflation over the major portion of the period and to the off-farm migration which has left assets behind in the hands of the financially able.

In this article we examine the changes that have occurred in each of three types of farms in terms of assets, expenses, and financing requirements. Trends in these characteristics, when interpreted in terms of causative factors, suggest problems that are likely to arise in the future.

Changes in Capital Use

During 1937-1941 the typical hog-dairy farm of west-central Illinois used a little more than $15,000 of total capital assets (Table 1). By 1947-1949 the capital had increased to $32,400. Most of the increase was due to war inflation. By 1958-1959 capital had increased to $49,840, an increase of 228 percent over 1937-1941. Although the pattern of change was the same for all three types of farms, the increases in capital assets were greater for the hog-beef fattening and cash-grain farms than for the hog-

Table 1. — Capital Assets on Three Types of Corn-Belt Farms, Valued in Dollars Current for Each Year, Selected Periods, 1937-1959

As of January 1	Acres in farm	Total capital	Percent	Land and buildings	Percent	Machinery and equipment	Percent	Livestock	Percent	Other assets	Percent
A. Hog-dairy farms, west-central Illinois											
1937-41	155	$15,200	(100)	$10,150	(66.8)	$1,490	(9.8)	$2,060	(13.6)	$1,500	(9.8)
1947-49	158	32,400	(100)	19,340	(59.7)	3,410	(10.5)	6,090	(18.8)	3,560	(11.0)
1952-54	161	42,210	(100)	25,387	(60.1)	5,407	(12.8)	6,893	(16.4)	4,523	(10.7)
1955-57	164	44,580	(100)	28,050	(62.9)	5,963	(13.4)	5,180	(11.6)	5,387	(12.1)
1958-59	167	49,840	(100)	31,635	(63.5)	6,310	(12.7)	7,225	(14.5)	4,670	(9.3)
B. Hog-beef fattening farms, northwestern Illinois											
1937-41	178	$20,380	(100)	$14,100	(69.2)	$1,840	(9.0)	$2,810	(13.8)	$1,630	(8.0)
1947-49	192	46,930	(100)	26,950	(57.4)	4,100	(8.7)	9,940	(21.2)	5,940	(12.7)
1952-54	197	60,760	(100)	36,180	(59.5)	6,840	(11.3)	11,250	(18.5)	6,490	(10.7)
1955-57	203	61,533	(100)	39,260	(63.8)	7,140	(11.6)	9,230	(15.0)	5,903	(9.6)
1958-59	210	70,345	(100)	45,475	(64.6)	7,220	(10.3)	11,960	(17.0)	5,690	(8.1)
C. Cash-grain farms, east-central Illinois											
1937-41	209	$29,950	(100)	$25,040	(83.6)	$1,860	(6.2)	$ 930	(3.1)	$2,120	(7.1)
1947-49	222	63,100	(100)	48,700	(77.2)	4,220	(6.7)	2,780	(4.4)	7,400	(11.7)
1952-54	226	88,253	(100)	68,783	(77.9)	7,083	(8.0)	3,063	(3.5)	9,324	(10.6)
1955-57	232	93,933	(100)	75,930	(80.8)	7,500	(8.0)	2,223	(2.4)	8,280	(8.8)
1958-59	235	108,430	(100)	90,255	(83.2)	7,530	(6.9)	3,095	(2.9)	7,550	(7.0)

Source: *Farm Costs and Returns.* U.S. Dept. Agr., Agr. Res. Ser. Agr. Info. Bul. 230. 1960.

dairy farms. On hog-beef farms (northwest Illinois) capital increased by 245 percent: from $20,380 in 1937-1941 to $70,345 in 1958-1959. Cash-grain farms (east-central Illinois) increased 262 percent: from $29,950 to $108,430.

Although inflation accounts for much of the increase in capital used in farming, there were substantial real increases. For the hog-dairy farms the increase amounted to 53 percent when all items are valued in 1947-1949 dollars. Total capital on hog-beef fattening farms increased by 61 percent and on the cash-grain farms by 69 percent. Thus we see that in 20 years assets on these farms have increased in "real" terms by more than 50 percent. Moreover, the increases show no signs of abating.

Asset structure changed surprisingly little over the period as a whole. Land and buildings declined as a percent of all assets for all three types of farms. The greatest decline occurred on the hog-beef fattening farms: from 69 percent to 65 percent (Table 1). Land and buildings comprise the largest percentage on cash-grain farms; 84 percent in 1937-1941 and still 83 percent in 1958-1959.

Machinery and equipment increased on all three types of farms, both absolutely and as a percent of all assets. In percent of all assets the gain was highest on hog-dairy farms: from 10 to 13 percent, and least for cash-grain farms: from 6 to 7 percent. Livestock as a percent of all assets increased slightly (from 14 to 15 percent) on hog-dairy farms and held constant at 3 percent on cash-grain farms, while increasing from 14 to 17 percent on the hog-beef fattening farms. It is apparent that the operators of the hog-beef fattening farms took this means to increase the scale of their operations.

These changes in capital structure are important because of the effect they have on the type of financing required by farmers in terms both of required collateral and of repayment programs. The relative decline in real property implies a relatively heavier financing burden on institutions through which nonreal-estate assets are financed. On the other hand, during the postwar period there has been an increase in machinery and equipment as a percent of all assets on the hog-dairy and cash-grain farms. This implies an increase in the average length of life of nonreal-estate assets which in turn may require a change in financing arrangements.

Changes in Production Expenses

We turn next to changes in cash expenses in the farm business. Total outlays on the hog-dairy farms increased from $1,986 to $6,574 between 1937-1941 and 1958-1959, an increase of 231 percent (Table 2). The striking increases are in outlays for feed purchases (361 percent) and for fertilizer and lime (1,429 percent). Though larger than for any other single expense component, outlays for the use of machinery and equipment increased at about the same rate as total outlays. Machinery and equipment expense was about 38 percent of all production expenses in 1937-1941 and was about the same percentage at the end of the period (Table 2).

The pattern of change differs a little as we look at the other two types of farms. The increase in total outlay was largest for the hog-beef fattening farms: from $3,222 to $14,934, an increase of 364 percent. Though relatively small in dollar terms, fertilizer outlays increased by 1,609 percent while outlays for livestock increased by 593 percent and feed purchases by 393 percent.

On cash-grain farms total outlays increased by 162 percent, a rate lower than for either the hog-dairy or the hog-beef fattening farms. As on other farms, the

Table 2. — Annual Cash Production Expenses on Three Types of Corn-Belt Farms, Selected Periods, 1937-1959

Period	All farm expenses	Percent	Machinery and equipment	Percent	Livestock	Percent	Feed purchases	Percent	Fertilizer and lime	Percent	Other expenses	Percent
A. Hog-dairy farms, west-central Illinois												
1937-41.....	$1,986	(100)	$ 762	(38.3)	$ 25	(1.3)	$ 254	(12.8)	$ 24	(1.7)	$ 921	(46.4)
1947-49.....	4,810	(100)	1,710	(35.6)	60	(1.2)	937	(19.5)	160	(3.3)	1,943	(40.4)
1952-54.....	6,646	(100)	2,191	(32.9)	64	(1.0)	1,091	(16.4)	256	(3.9)	3,044	(45.8)
1955-57.....	5,945	(100)	2,181	(36.7)	67	(1.1)	1,108	(18.6)	261	(4.4)	2,328	(39.2)
1958-59.....	6,574	(100)	2,491	(37.9)	77	(1.2)	1,170	(17.8)	367	(5.6)	2,469	(37.5)
B. Hog-beef fattening farms, northwestern Illinois												
1937-41.....	$3,222	(100)	$ 894	(27.6)	$1,134	(35.1)	$ 311	(9.6)	$ 22	(1.0)	$ 861	(26.7)
1947-49.....	9,816	(100)	2,054	(20.9)	3,874	(39.5)	1,810	(18.4)	157	(1.6)	1,921	(19.6)
1952-54.....	12,175	(100)	2,614	(21.5)	5,077	(41.7)	1,707	(14.0)	227	(1.9)	2,550	(20.9)
1955-57.....	12,049	(100)	2,200	(18.3)	5,181	(43.0)	1,956	(16.2)	212	(1.8)	2,500	(20.7)
1958-59.....	14,934	(100)	2,510	(16.8)	7,859	(52.6)	1,533	(10.3)	376	(2.5)	2,656	(17.8)
C. Cash-grain farms, east-central Illinois												
1937-41.....	$2,118	(100)	$ 977	(46.1)	$ 19	(.9)	$ 105	(5.0)	$ 62	(2.9)	$ 955	(45.1)
1947-49.....	4,945	(100)	2,221	(44.9)	37	(.8)	360	(7.3)	352	(7.1)	1,975	(39.9)
1952-54.....	6,620	(100)	2,853	(43.2)	42	(.6)	492	(7.4)	681	(10.3)	2,552	(38.5)
1955-57.....	6,544	(100)	2,823	(43.2)	42	(.6)	482	(7.4)	754	(11.5)	2,443	(37.3)
1958-59.....	5,556	(100)	2,914	(52.4)	42	(.8)	492	(8.9)	936	(16.8)	1,172	(21.1)

Source: *Farm Costs and Returns.* U. S. Dept. Agr., Agr. Res. Ser. Agr. Info. Bul. 230. 1960.

outstanding increase in percentage terms is found in fertilizer and lime: 1,410 percent. However, this item is far more important for the cash-grain farms where fertilizer expenses exceed those for any other category except machinery and equipment. The dollar increase on cash-grain farms was largest for expenditures in the use of machinery and equipment. This was true also for the hog-dairy farms. On the hog-beef fattening farms the dollar increase for machinery use was second only to the increase for livestock.

Again, our primary interest in these changes is to determine first the change in total outlays and then those changes in the structure of cash outlays that affect the financing requirements of farm operators. The evidence indicates a considerable change in expenses arising from increased use of resources originating off farms, which in turn increases cash costs and the financing requirements.

Changes in Resource Requirements

With this information, we can estimate changes in the amount of capital required to finance each of these three types of farms. Assume first that all land and buildings must be paid for in an average of 20 years and financed at an interest rate of 5 percent. This period would be too short for land, the most valuable single asset involved. On the other hand, it is too long for most other real-estate items. We selected 20 years rather arbitrarily to represent the time period intermediate between the longest and shortest appropriate for the various real-estate assets. For machinery and equipment we assumed that replacement must occur for all items at an average of once each five years and be financed at an interest cost of 6 percent.

For each year we amortize the value of land and buildings at 5 percent over a 20-year period. To the result of this calculation we add the amortization of the value of machinery and equipment at 6 percent over five years. We take this sum to represent the annual cost to replace capital assets on the average for the periods shown in Table 3. The sum thus includes what is an actual interest bill to the extent that credit is used to finance purchases. To the extent that he pays cash for the assets, the interest component is a "paper cost" to the operator. In column 1, Table 3, we give

Table 3. — Annual Financing Requirements for Business Purposes on Three Types of Corn-Belt Farms, Selected Periods, 1937-1959

Period	For capital assets[a]	For cash outlays[b]	Total for farm business[c]
A. Hog-dairy farms, west-central Illinois			
1937-41.....	$1,169	$ 1,986	$ 3,155
1947-49.....	2,362	4,810	7,172
1952-54.....	3,321	6,646	9,967
1955-57.....	3,667	5,945	9,612
1958-59.....	4,037	6,574	10,611
B. Hog-beef fattening farms, northwestern Illinois			
1937-41.....	$1,568	$ 3,222	$ 4,790
1947-49.....	3,168	9,816	12,984
1952-54.....	4,527	12,175	16,702
1955-57.....	4,845	12,049	16,894
1958-59.....	5,363	14,934	20,297
C. Cash-grain farms, east-central Illinois			
1937-41.....	$2,451	$ 2,118	$ 4,569
1947-49.....	4,911	4,945	9,856
1952-54.....	7,201	6,620	13,821
1955-57.....	7,874	6,544	14,418
1958-59.....	9,030	5,556	14,586

[a] Value of land and buildings (column 3, Table 1) amortized at 5 percent over 20 years plus value of machinery and equipment (column 4, Table 1) amortized at 6 percent over five years.
[b] From column 1, Table 2.
[c] Sum of column 1 and column 2.

annual requirements that must in the long run be met to replace capital items according to our estimates.

In column 2, Table 3, we show (from Table 2) the average cash outlays needed to operate each farm for a year for each of the periods shown. With few exceptions both requirements have increased continuously over the period for each type of farm. The sum of these estimates, given in column 3, describes the total resources to be financed from income, or from outside financing sources. The requirement for capital assets can, of course, be avoided for short periods of a year or so. But they eventually need to be met.

The total financing requirement is higher throughout the period on the hog-beef fattening farms than on either of the other two types of farms. The increase also is greatest on the hog-beef fattening farms, followed in order by cash-grain and hog-dairy farms. Though requirements for capital assets are largest throughout the period on the cash-grain farms, the farms differ little in rate of increase over the period in this category of financing requirements.

It should be noted that while the financing requirements of the hog-dairy and cash-grain farms have slightly more than tripled, those for the hog-beef fattening farms have quadrupled since 1937-1941. This difference is especially significant to commercial lenders inasmuch as the percent of all assets comprised of nonreal-estate assets is much the largest in this type of farm.

Sources of Capital

Where does the money come from? In Table 4 we give estimates of total cash receipts and cash outlays made for family living expenses. By subtracting living expenses from the cash receipts, we derive an estimate of the amount available from current income to finance capital assets and cash expenses for the "next year." The amount by which this sum exceeds financing requirements is shown in the last column. A negative figure here means that the farm business fails in that year to supply from income all that is needed to finance its current operation plus the replacement of capital assets at the required average rate.

In the reference cited in Table 4, T. Wilson Longmore and Carl C. Taylor estimated that farm families in the North Central Region of the United States increased (or decreased) household expenditures by about 25 cents for every $1 increase (or decrease) in cash income. This estimate was used in adjusting living-expense data furnished by the Department of Home Economics, University of Illinois, to reflect expected household expenditures on farms typical of the three types of farms in Illinois. The data on living expenses were ob-

Table 4. — Income Available Annually to Finance Assets on Three Types of Corn-Belt Farms, Selected Periods, 1937-1959

Period	Total cash receipts[a]	Cash outlays for family living[b]	Cash available for farm business[c]	Cash in excess of requirements	
				For cash outlays[d]	For cash outlays and replacement of capital assets[e]
A. Hog-dairy farms, west-central Illinois					
1937-41	$ 2,980	$1,205	$ 1,775	$−211	$−1,380
1947-49	9,686	3,066	6,620	1,810	−552
1952-54	10,678	3,208	7,470	824	−2,497
1955-57	10,485	2,785	7,700	1,755	−1,912
1958-59	12,402	2,667	9,735	3,161	−876
B. Hog-beef fattening farms, northwestern Illinois					
1937-41	$ 4,700	$1,326	$ 3,374	$ 152	$−1,416
1947-49	19,630	4,300	15,330	5,514	2,346
1952-54	20,098	3,998	16,100	3,925	−602
1955-57	17,759	4,612	13,147	1,098	−3,747
1958-59	22,464	5,176	17,288	2,354	−3,009
C. Cash-grain farms, east-central Illinois					
1937-41	$ 3,906	$1,404	$ 2,502	$ 384	$−2,067
1947-49	13,085	3,882	9,203	4,258	−653
1952-54	13,748	3,799	9,949	3,329	−3,872
1955-57	13,203	3,465	9,738	3,194	−4,680
1958-59	13,388	2,908	10,480	4,924	−4,106

[a] *Farm Costs and Returns.* U. S. Dept. Agr., Agr. Res. Ser. Agr. Info. Bul. 230. 1960.
[b] Cash expense for family living, averaged for Illinois farm families cooperating with the Department of Home Economics, University of Illinois, plus total cash receipts given in column 1 × 0.25. The last figure, 0.25, is an estimate of elasticity of expenditures for living expenses with respect to farm income (see T. Wilson Longmore and Carl C. Taylor, "Elasticities of Expenditures for Family Living," *Journal of Farm Economics* 33:1-19, 1951).
[c] Column 1 minus column 2.
[d] Column 3 minus column 2, Table 3.
[e] Column 4 minus column 1, Table 3.

tained from farm families who cooperate with the University of Illinois in keeping home accounts. Expenses recorded by these families were adjusted by adding (or subtracting) the difference between their total cash receipts and those given in column 1, multiplied by 0.25.

Cash available for farm business (column 3) is simply the difference between columns 1 and 2. In column 4 we show the amount of cash available over amount required to meet actual cash outlays. This is the sum available to replace capital assets. In the last column we show the excess (if any) above these capital requirements.

We note from these estimates that income was sufficient to meet cash outlays for all types for all years except for hog-dairy farms in the prewar period. We also note that while the cash income in excess of cash outlays has been larger since World War II, the increase has been uneven for all three types. The hog-beef fattening farms display wide variation in these estimates.

In the long run capital must also be replaced. The ability to do so from current income is shown by estimates in the last column. The most obvious conclusion is that current income has failed generally to provide enough to meet cash outlays and household living expenses and to replace capital assets at the rates assumed here.

The fact that most of these numbers are negative does not mean that these types and sizes of farms are all going bankrupt. First, as mentioned previously, it is possible to postpone, temporarily, the replacement of capital assets. This occurred during the 1930's and during the capital-short years of World War II. Second, farms in all three types have been growing, as measured either in acres or in all assets valued in constant dollars. Hence the estimates of capital replacement requirements actually include additions as well as simply replacements.

The trends in estimates are indicative, however, of the growing importance of

financing problems. Over the past two decades, many of these problems have been effectively masked by two factors. One is the rapid consolidation of farms which has occurred in the wake of substantial off-farm migration. Second, the age structure of farm operators indicates that many farm assets are held by elderly persons. On transfer of these assets to a succeeding generation, we can expect a more urgent awareness of financing problems. Therefore this is an appropriate time to inquire into financing alternatives.

Alternative Sources of Finance

Apart from current income the farm operator can finance the use of farm assets only by using credit or by some sort of lease, contract, partnership, or other type of arrangement that augments actual resource ownership.

Where land is an especially important part of total farm investment, one might expect financing pressures to be reflected in a high incidence of tenant-operated farms. We see from the last column of Table 4 that financing pressures are greatest for cash-grain farms. We know also that the incidence of tenant-operated farms is highest where cash-grain farming is dominant. Here it is comparatively easy to divide ownership of farm assets. The result is to make, on the whole, a more tolerable financing arrangement for all concerned than would be possible were all farm assets to be owned by the actual farm operator. For Illinois as a whole the percent of farmland operated under lease is fairly stable at more than 50 percent. However, percent of farms under lease varies between 30 and 45 percent, generally with variation in the level of prosperity.

The evidence regarding finance of nonreal-estate assets is extremely fragmentary. We know the farmers' opportunities to finance assets differ among assets. In 1936, for example, 62 percent of loans made by merchants and dealers were made for machinery and equipment. As feed purchases assume greater importance in the farmer's cash budget, will he turn increasingly to dealer-financing schemes here too? Broiler producers have furnished a dramatic example in the past decade. Many analogies have been drawn, far too glibly, to predict the future for hog producers and perhaps for cattle feeders as well. Yet, this is a prospect that bears watching by both the farmer and the commercial lender.

We need to recognize that farming as we know it today rests quite heavily on the operator's access to financing sources that are independent of particular assets to be financed. By using his own income or a commercial lender, the farm operator decides whether to feed cattle, milk cows, buy fertilizer, buy another equipment item, etc., in terms of his own producing situation. As soon as the machinery dealer, feed dealer, or packing company offers a package comprised of merchandise and a financing arrangement, the operator's decision is immediately conditioned by the terms of the financing scheme. For example, should he find it easier to finance a combine through a dealer than to finance the purchase of fertilizer through a commercial lender, he may decide in favor of the combine.

Most dramatic of all alternatives is the prospect of further fragmenting the ownership or control of resources used in farming. As the financing deficit increases, so also does the pressure increase to find new financing schemes. The commercial lender has a large stake in helping farmers hold down this deficit, through financing operations to enhance the level of farm income. Beyond this much can be done to adapt financing in-

struments to changes in farm asset requirements. For example, "intermediate" loans are made more important by many of the mechanical innovations now current in agriculture.

Finally, despite all such adjustments, we may well expect considerably more "integration" between farm and nonfarm interests. The trends in financing requirements certainly suggest both the possibility and the means to accomplish it. Such a change would alter still further the character of agriculture and especially the role played by commercial lenders. Commercial lenders are directly concerned with the prospect that resources used in agriculture would be financed increasingly within a corporate structure and with corporate techniques. Insofar as the corporate structures would originate outside agriculture, actual ownership would be even more remote from the decisions regarding the use of resources than is the case with existing corporations. Will our society be better served? We do not know. We would probably attract more capital into agriculture, controlled in larger and larger blocks, reduce the quantity and change the quality of labor, and shift the site of decisions that shape the kind of agriculture we would have.

The Japanese Soybean Market

HIROSHI NAKAMURA

IN JAPAN SOYBEANS ARE CONsidered a food grain like rice and wheat and, in fact, serve as an important source of protein supply in the Japanese diet. Total annual consumption exceeds 1,500,000 metric tons; but as production in Japan is only 400,000 tons, more than a million tons of soybeans are imported each year, mostly from the United States. Of all the agricultural exports of the United States to Japan, soybeans today occupy the most important position, amounting to nearly 100 million dollars per year. Thus soybeans are an important item of trade between the United States and Japan, and it will be of some interest to study characteristics of the growing soybean market in Japan and see its problems and future prospects in relation to U. S. soybeans.[1]

[1] L. S. Hardin and L. F. Hesser of Purdue University made a study of market development programs for U. S. agricultural commodities, including soybeans, in the summer of 1960, in which the present writer participated as a research assistant. Some of the material in this article was developed at that time.

Soybeans in the Japanese Diet

Soybeans have been grown in the Orient, including China and Japan, for hundreds of years, and have been utilized as food in a great number of different ways. Some of the soybean food items, such as shoyu or soy sauce, tofu or soybean curd, and miso or soybean paste, are now familiar to some of the American people. In addition, such soybean foods as natto or fermented soybeans, kinako or roasted soybean flour, and aburage or fried tofu are popular items in the Japanese family. Collectively these soybean foods are an important source of protein in the Japanese diet, which consists mainly of starchy food such as rice, other cereals, and vegetables, with some supplement of protein by fish.

Even with these soybean foods, however, the Japanese diet remains very low in protein and fats and oils when compared with the rich American diet. According to the United Nations statistics of caloric intake per person per day in 1957, the U. S. caloric intake of 3,100

calories consisted mainly of 765 calories of cereals and other starchy food; 1,084 calories of meat, milk, eggs, and other livestock products; and 492 calories of fats and oils.[2] In comparison, the Japanese intake of 2,270 calories per person per day consisted of 1,636 calories of cereals and other starchy food; 59 calories of meat, milk, eggs, and other livestock products; and 78 calories of fats and oils. In terms of animal protein intake, a U. S. consumer takes 66 grams of animal protein per day, while a Japanese consumer takes only 17 grams. Starchy food makes up only 25 percent of the American diet but 72 percent of the Japanese diet.

It is clear that in spite of all the traditional soybean foods in the Japanese diet, the consumers in Japan need considerably more protein and fats and oils in their diets. It may be pointed out, however, that although the Japanese diet is much lower in total caloric value than the American diet, according to the FAO estimate, it is possible that the Japanese caloric intake is actually a little higher in relative terms than the statistics show. When we consider other factors, such as the difference in average weight between the American and the Japanese and the waste of food, which is likely to be greater in the U. S. than in Japan, the differences in caloric intake may not be as pronounced as indicated by the data. But this does not change our conclusion from the caloric comparison that a substantial difference in caloric intake exists between the two countries; and even if we agree that the total caloric intake in Japan is adequate for the Japanese in terms of calories, it is quite evident that quality changes in the diet are desirable. Later references will be made to the possible diet changes in this respect.

[2] *Yearbook of Food and Agricultural Statistics.* Food and Agricultural Organization, United Nations. 1958.

Patterns of Soybean Consumption

We have seen that soybeans, sometimes called "the meat of the fields," have traditionally been a part of the Japanese diet. In addition, soybean oil is a major cooking oil in the Japanese household. In order to see the aggregate of all these uses in terms of quantity, let us now consider the pattern of soybean consumption in Japan.

During the 1930's Japan consumed about one million metric tons or 36.7 million bushels of soybeans each year, of which 30 to 35 percent was from domestic production, the rest being imported from Manchuria. Of the one million tons, about 40 percent was crushed into oil and meal, and the remaining 600,000 tons were used as whole soybeans in manufacturing of various soybean foods, including about 200,000 tons used by growers themselves.

Even during the war years, nearly half a million tons of soybeans were imported annually from Manchuria. This trade, however, came to a complete stop at the end of the war. Domestic production increased after the war and reached half a million tons in 1952, but has not shown any increase since that time, perhaps due mainly to the availability of U. S. soybeans. The prewar level of one million tons was reached in 1954 to 1955; but since the population increased by nearly 20 millions during the period, the per capita consumption of soybeans per year was only 10.4 kilograms (23 pounds) in 1954 compared with 14.5 kilograms (32 pounds) in the 1934-1936 period. Interestingly enough the ratio of consumption of soybeans between crushing and food uses in 1954 was about the same as that in prewar years, about 40 percent for crushing and 60 percent consumed as whole soybeans in manufacturing of various soybean foods (Table 1).

Table 1. — Soybean Supply and Consumption in Japan, 1934-1936 Average and 1950-1959

Fiscal year (April-March)	Domestic production	Imports	Crushings	Used as whole soybeans[a]	Percent of imports from United States
			(metric tons)		
1934-1936	303,000	700,000[b]	400,000[b]	600,000[b]	..
1950	447,000	218,000	258,000	497,000	47
1951	474,000	323,000	162,000	625,000	95
1952	521,000	296,000	284,000	535,000	97
1953	429,000	541,000	380,000	568,000	91
1954	376,000	576,000	417,000	509,000	75
1955	507,000	767,000	505,000	735,000	75
1956	456,000	667,000	547,000	625,000	72
1957	458,000	846,000	691,000	582,000	76
1958	391,000	951,000	769,000	571,000	91
1959	426,000	1,073,000	775,000	735,000	94

[a] Computed as residual from total supply minus crushings minus carryover.
[b] Estimates.
Source: Finance Ministry's Monthly Trade Report; Domestic Production, by Japanese Ministry of Agriculture Statistics.

In the past few years soybean consumption has steadily increased, and in 1958 the average per capita consumption reached the prewar level of 14.5 kilograms (32 pounds) per year. In 1959 total consumption amounted to one and a half million tons, and it is expected to increase further in the future. But in the course of increasing consumption in recent years, the ratio of consumption by the crushing industry and the food industry has changed, and today the crushing industry uses more soybeans than the growers and the soybean food industry manufacturing miso, tofu, shoyu, etc. The statistics indicate that the soybean consumption in the food industry has been quite stable or even slightly decreasing in terms of per capita consumption (see Table 2), while the crushing industry has been using increasing quantities of soybeans each year. This means that soybean oil consumption is increasing and uses of soybean meal are also expanding. In fact, soybean meal today is successfully used even in tofu and fish sausage manufacturing in addition to its established uses in manufacturing of soy sauce and miso, the two main uses of soybean meal in Japan during and since the war. The use of soybean meal in feed manufacturing is also becoming more and more important, as the livestock industry grows rapidly to meet the increasing demand for livestock products.

Table 2. — Total and per Capita Consumption of Specified Soybean Foods and Edible Oils in Japan, 1934-1936 Average and 1953-1957

Fiscal year	Total consumption	Per capita per year	
	(metric tons)	(kg.)	(lb.)
Miso or soybean paste			
1934-1936	711,000	10.4	22.92
1953	852,000	9.8	21.60
1954	857,000	9.7	21.38
1955	885,000	9.9	21.82
1956	895,000	9.9	21.82
1957	815,000	8.9	19.62
Shoyu or soy sauce			
1934-1936	949,000	13.8	30.42
1953	1,136,000	13.1	28.88
1954	1,241,000	14.1	31.08
1955	1,277,000	14.3	31.52
1956	1,316,000	14.6	32.19
1957	1,247,000	13.7	30.20
Edible oils			
1934-1936	61,000	0.9	1.98
1953	170,000	2.0	4.41
1954	180,000	2.0	4.41
1955	245,000	2.7	5.95
1956	270,000	3.0	6.61
1957	288,000	3.2	7.05

Source: 1958 White Paper on People's Living by Economic Planning Agency.

Changes in Tastes and Preferences

The quality of soybean oil has been greatly improved in the past few years, and today it is used as a standard oil for cooking and salad dressing. While soybean oil is thus used in increasing quantities, the consumption of traditional Japanese soybean foods, such as miso and shoyu, has not shown any sign of increase in the past decade. It is doubtful whether the per capita consumption will increase in the future. This is apparently due to changes in consumers' tastes and preferences, which in turn are closely related to the income level of the consumers.

Income elasticities of demand have been estimated by the Japanese Ministry of Agriculture for certain commodities, including miso, shoyu, tofu, fats and oils, livestock products, etc. According to these estimates, miso has a negative income elasticity of less than -1.0. This means that with a 1-percent increase in income the quantity purchased decreases more than 1 percent. Shoyu has an income elasticity somewhere between 0 to -0.5, tofu between 0 and $+0.5$, soybeans as a whole $+0.5$ to $+1$, and fats and oils and livestock products above $+1$. These estimates tell us that as the income of the Japanese consumer increases, the consumption of traditional soybean foods decreases, while the consumption of fats and oils and livestock products increases more rapidly than the rate of income increases. Per capita income in Japan has increased by almost 8 percent per year since 1954, and it is estimated that the Japanese economy will continue to grow for several years at an annual rate of 7 percent. This economic progress will clearly favor the consumption of soybean oil and livestock products, and the livestock industry is likely to consume increasing quantities of soybean meal as feed in future years.

Preferences for Types of Soybeans

Japanese soybean users have a distinct preference for certain types of soybeans. We have already seen that there are two major types of use of soybeans, one by crushers and the other by soybean food manufacturers. The crushers prefer beans with high oil content, which means they prefer American soybeans which are higher in oil content than the domestic or Chinese soybeans. At the same time crushers object to the higher content of foreign materials in U. S. soybeans. Recently the quality of U. S. soybeans in this respect has been improved and there is improved acceptance, although certain problems remain, such as the problem of morning glory seed mixed with the soybeans. On the other hand, soybean food manufacturers have traditionally depended upon domestic and Chinese soybeans; and because of their nature of manufacturing, that is to say, to use whole soybeans directly as food, they prefer soybeans of yellow color, uniform size, and high protein content, with no foreign material. In the postwar period, they had many complaints about U. S. beans, above all, about the foreign materials, percentage of green beans, irregularity of size, and black hilum. But in the past few years, assisted by the promotional and educational activities of the Japanese-American Soybean Institute, they have developed preferences for specific varieties of U. S. soybeans, in particular Harosoy and Hawkeye; and today they are willing to pay premiums for soybeans of these varieties. Harosoy seems to be most preferred because of its good characteristics for soybean food manufacturing. At present, shipments of these varieties are very limited, but with this new development the U. S. can now meet all the requirements of the Japanese soybean industry, both for crushing and for food

manufacturing. This is a significant achievement of U. S. soybean producers and exporters.

Supply of Soybeans to Japanese Market

As noted above, Japan's total annual consumption of soybeans in 1959 was about 1,500,000 tons. Since domestic production has been quite stable at about 400,000 tons during the past ten years, increased consumption has been possible only with increased imports. Small quantities were imported from China during 1952-1954. Imports from that source reached 200,000 tons in 1955, 1956, and 1957, but since the discontinuance of trade with mainland China in May, 1958, no soybeans have come from China. Accordingly, the U. S. has become the chief supplier, and soybean imports from the U. S. increased from 72 percent of total imports in 1956 to 94 percent in 1959. A very important development in this respect, from the U. S. standpoint, is that in the past few years American soybeans have become the accepted raw material not only by the crushing industry but to a great extent also by the soybean food industry, which uses about half a million tons of whole soybeans each year in addition to using a fairly large quantity of soybean meal. The crushing industry used about 800,000 tons of soybeans in 1959 and the farmers themselves about 200,000 tons in their home manufacturing of soybean foods. Details are not available on the uses of approximately 600,000 tons of soybean meal manufactured from the crush of 800,000 tons of beans, but it may roughly be estimated that about 300,000 to 350,000 tons were used for manufacturing soy sauce, miso, tofu, and other food items, and 250,000 tons for feed and other nonfood uses.

Japan is by far the biggest market for exports of U. S. soybeans (Table 3). Of the total U. S. soybeans going to Japan, Illinois soybeans have been especially preferred for their better quality (higher oil content and less foreign materials), and in fact have been imported at a premium of a few cents per bushel over beans from other areas. Although no accurate figures are available, it is thought that in recent years approximately half of Japan's total soybean imports from the U. S. have been shipped out of Illinois.

Soybean Production in Japan

As noted above, the production in Japan has not increased in the past ten years. Production has been stable in spite of various measures of protection, such as the 10-percent import duty since October, 1956, the high support price of $140 per metric ton ($3.81 per bushel) for the past few years, and the import restrictions by the foreign exchange allo-

Table 3. — U. S. Exports of Soybeans by Country and Area, 1955-1960, Year Ending September 30

	1955	1956	1957	1958	1959	1960[a]
			(1,000 bushels)			
Canada	8,107	8,890	10,191	10,729	15,173	15,764
Japan	20,350	20,402	22,882	26,822	36,708	40,633
Netherlands	7,369	9,140	14,151	10,844	15,598	26,328
West Germany	8,045	12,633	15,139	11,158	13,200	15,301
Other Europe	9,703	10,599	14,678	15,771	17,045	28,737
Others	7,045	5,819	8,320	10,183	12,348	14,840
Total	60,619	67,483	85,361	85,507	110,072	141,603

[a] Preliminary.
Source: U. S. Bureau of the Census.

cation system. It is very likely that Japanese production will decrease rapidly, particularly in the main producing area of Hokkaido (the northernmost island) if the present import restrictions under the exchange allocation system are removed and soybean imports are placed under the automatic approval system whereby imports can be made freely at any time from any source of the world.

Of Japan's total production of soybeans, Hokkaido produces each year 20 to 25 percent or 80,000 to 100,000 tons and overwhelms other prefectures, most of which produce 10,000 tons or less, chiefly for farmers' own uses. Hokkaido's production is commercially marketed and accounts for nearly half of the domestic soybeans traded on the market. Other supplies come into the market from producing areas in northeastern Japan; but as a whole, except for the production in Hokkaido, soybeans in Japan are not a commercial crop. However, the existence of the domestic production of about 400,000 tons and the price-support system in the interest of domestic producers keep prices of soybeans in Japan artificially high as compared with world prices. This hampers the increase of consumption as does the quota system of imports based on the historic business volume and plant capacity of each individual crusher and food manufacturer.

Prior to the 1958 crop the market prices for domestic soybeans were generally higher than the support price and all available quantities were sold to the soybean food manufacturers. But as increasing quantities of the 1959 crop of U. S. soybeans became available at much lower prices than for the domestic beans, and particularly with shipments of preferred varieties, the food manufacturers came to use more and more U. S. soybeans, with the result that the market prices for domestic soybeans went below the support level. In 1960 it became clear that not all the domestic beans coming to the market could be sold to the food manufacturers at prices above the support level, and the Japanese government was confronted with the problems of disposing of some 30,000 tons of domestic soybeans. Since the government regulates all soybean imports, the Ministry of Agriculture in the interest of domestic growers immediately resorted to withholding the issuance of import permits for some time and succeeded in disposing of these beans at the support level. The crushers and the food manufacturers had to buy these beans in order to get the import permit for their individual allocations, and they did this at a price higher than that of the free market.

As long as the present high support level for domestic soybeans is maintained and the import system of exchange allocation to individual firms is in effect, this situation could happen again.

Future of Soybean Consumption in Japan

The crushing industry will use increasing quantities of soybeans to meet increasing demand for soybean oil and soybean meal as consumer income rises and creates a stronger demand for fats and oils and livestock products. According to estimates of the Investigation Commission on Basic Problems of Agriculture, Forestry, and Fisheries, an advisory organ to the Japanese government, the consumption of fats and oils and meat in Japan will be more than doubled during the coming ten years, and milk consumption will more than triple during the same period. It is clear that all these changes in dietary habits will favor the consumption of soybeans. In addition, the soybean food industry will continue to use about half a million tons each year, perhaps somewhat more with the increase

of population and with the farmers' home consumption remaining at almost the same level.

Total consumption seems certain to increase in the future. However, the rate of increase will be somewhat limited under the present import system of foreign exchange allocation, which is based on the government's conservative estimates of fats and oils consumption and subsequent import exchange allocation to individual firms on the basis of past business records and plant capacity to meet the expected demand. In the past, the actual consumption has tended to increase faster than the government estimates, creating from time to time a tight supply situation of soybean products, with resulting higher prices in the market. Naturally, the limited supply due to the import quota and subsequent high prices of soybeans will hinder the trend of increasing soybean consumption in Japan. These import restrictions are directly related to Japan's position of international payments, especially with the dollar area, and also to the protection of domestic growers of soybeans. As pointed out earlier, any increase in consumption must come from increased imports under the present circumstances in which we cannot expect any major increase in soybean production. The government policy on imports will therefore be an important influence on the future consumption of soybeans in Japan, and we will next briefly consider this problem.

Japanese Government Import Policy

Recently Japan's international payments position improved markedly, and justification for import restrictions from this point of view has become rather weak. In line with the world trend to liberalize international trade, the Japanese government has also removed many restrictions upon imports, and some commodities are on a schedule of liberalization in the near future. In the case of soybeans, the problem of liberalization becomes complicated because of the existence of domestic growers who object.

Tentative programs for revision of import policy were announced in August, 1960, but it seems that no definite decisions have as yet been made. If put into effect, the programs, which consist essentially of raising the import duty in exchange for liberalization of soybean trade, will tend to diminish the rate of increase in soybean imports even if general import policy is liberalized. These programs will certainly influence adversely the volume of soybean imports as well as the total demand for soybeans through the concomitant higher prices of soybeans in the Japanese market.

A potential for increased soybean consumption exists among 93 million consumers in Japan, but favorable forces for increased consumption are somewhat offset by the high support level for domestic soybeans and the subsequent restrictive import system. For the United States as a supplier of soybeans to the Japanese market, these offsetting influences also have a somewhat adverse effect on increasing soybean exports to Japan. Resumption of trade with mainland China and imports from that source could again reduce the U. S. share of the market. This would probably occur only to some limited extent, since U. S. soybeans today are successfully utilized not only in the crushing industry, but also in the food industry and in many cases are much preferred because of their physical characteristics and the dependable nature of their delivery.

A Review of Studies Dealing With the Effect of Price on Consumption of Fluid Milk

LOWELL E. WILSON

A NUMBER OF FACTORS, BOTH economic and noneconomic, affects the quantity of milk consumed. The retail price is considered one of the major economic factors affecting consumption. Since dairy marketing researchers have long been interested in determining the influence of retail price on rate of consumption, a considerable amount of literature is available on the subject. The purpose of this paper is to review a number of studies dealing with the effect of changes in retail prices on consumption of fluid milk.

The effect on consumption of changes in price of milk is often measured by the concept of price elasticity of demand. This concept is defined as the percentage change in consumption for a given percentage change in price. Since the quantity demanded varies inversely with price, demand elasticities have a negative value. Demand schedules for which the absolute value of elasticity is less than 1 are said to be inelastic.

If the demand is inelastic, a 1-percent change in price is accompanied by a less than 1-percent change in quantity; if elastic, quantity changes more than 1 percent in response to a 1-percent change in price. Total revenue (price times quantity) is increased following a price increase if the product has an inelastic demand, but is decreased with a price increase if the demand is elastic.

Various estimates of short-term elasticities of demand for fluid milk are reported in this article. Short-term elasticities refer to the more immediate response of consumers to a change in price. If the new price level is maintained over a period of time, the adjustment of purchases of consumers, and hence price elasticities, may be different from the short-term situations considered in the studies under review.

The studies examined have been grouped into two categories. The first deals with consumption response to small changes in price and the second concerns consumption response to large changes in price. Studies used in the first category are summarized by Rojko (9) in a technical bulletin entitled "The Demand and Price Structure for Dairy Products." Since the studies summarized were made during different periods of time, in different markets, and under different marketing and merchandising conditions, it must be emphasized that the elasticities derived are not comparable in many respects. However, by examining a few of the attempts to measure the effect of price changes on consumption of fluid milk, some understanding of consumer response to price change can be gained.

Consumption Response to Small Changes in Price

Most studies have indicated that the demand for fluid milk is highly inelastic with respect to price. One of the early studies made by Ross (10) in the Chicago market during the period 1920-1922 indicated that consumers tended to vary purchases of milk inversely 0.1 percent for each 1-percent change in the retail price (Table 1). The price of quarts ranged from 12 to 16 cents, and pints from 7 to 10 cents. Short-run changes during the 3-year period were for only 1 cent at a time. In another study covering the years 1919-1924, Ross (11)

Table 1. — Short-Term Elasticities of Demand for Fluid Milk With Respect to Price for Specific Periods and Markets[a]

Market	Period analyzed	Elasticity
Chicago	1920-1922	−.1
New York, metropolitan area	1919-1924	−.1
Baltimore	1922-1931	−.28
Boston	1922-1931	−.06
Connecticut	1922-1931	−.14
Several selected markets	1934-1935	−.28
New York, metropolitan area	1933-1937	0 to −.2
New York, low-income areas	1938-1940	−.33
Portland, Maine	1948	−.45
Eastern Connecticut, community	1948-1949	−.48
Memphis, Tennessee	1952-1953	−.4

[a] Source: Rojko (9).

found an elasticity of −0.1 for the New York metropolitan area. Price of milk changed a great number of times during the period. The data indicated that the changes in sales following a 1-percent change in price were almost negligible when consumers recognized the necessity of fluctuating prices. Ross went on to state that a limit undoubtedly exists beyond which the price cannot be advanced without a sharp fall in demand and that the conclusions are intended to apply only to price changes within reasonable limits.

Cassels (3) showed average changes in consumption of fluid milk in three markets during 1922-1931 to range from −0.06 to −0.28 percent for each percentage change in price. In these markets the price of milk averaged about 15 cents per quart. The variations from this average were relatively small, averaging 6.5 percent. In the Baltimore market, where only six price changes occurred during the ten years, the changes in sales following changes in price were erratic. In the Connecticut markets 12 price changes occurred; in the Boston market, 34. In no case was an increase in price followed by a decline in sales proportionately greater than the price increase. Cassels said that consumers who buy their milk in chain stores are more likely to be price responsive than those who get milk from wagon distributors. He concluded that even in the long run the demand for fluid milk is not likely to be elastic.

Gaumitz and Reed (5) found the average elasticity to be −0.28 for several selected markets. They also concluded that the demand for milk is highly inelastic, especially when retail-price changes are relatively small. They went on to say that "When prices changes are relatively large, it is possible that the change in consumption may be somewhat greater than when the changes in the retail price are relatively small, although the change in sales is probably less than directly proportional to the change in price."

In a study made in New York City from 1938 to 1940, Blanford (1) found that purchases of milk through grocery stores in low-income areas were reduced about 1 percent for each 3-percent increase in price. Blanford found that most purchases of milk in low-income areas were through grocery stores, while in medium- and high-income areas many families purchased milk from retail routes. In an earlier study for the New York metropolitan area covering the period 1933-1937, Blanford found demand elasticities ranging from 0 to −0.2.

In general, studies for the years prior to 1940 indicated the demand for milk to be quite inelastic with respect to price. But estimates made after World War II indicate an increase in elasticity.

Luke (7) in a study of milk consumption in the Portland, Maine, market in 1948 found that consumers tended to reduce consumption of fluid milk 0.45 percent for a 1-percent change in price.

The conclusion was that minor changes in price of milk do not ordinarily bring large, immediate responses in quantities of milk sold. Several reasons were suggested for this lack of response to a small price change.

1. Consumers are indifferent to the price of milk. They think that milk is a good buy and well worth the price.

2. Food habits of consumers are adjusted slowly.

3. Consumers believe that price changes are temporary.

4. Changes in prices (generally increases) are keeping up with trends in the general price level.

Brinegar (2) in a 1948-1949 study made in an eastern Connecticut community found elasticity to average −0.48. He studied changes in the consumption of milk on the basis of amounts purchased in the 4-week periods before and after a change in the price. For three periods in 1948 and 1949, he calculated price elasticity to be −0.73 and −0.38 following price increases of 1 cent and 1.5 cents respectively, and −0.32 following a price decline of 1 cent. He gave no reasons as to why consumption response to price was greater at one time than at others. Further examination of the data, however, revealed that not all persons included in the study were aware of the price of milk. In order to respond to price changes, the consumer must be aware of price. However, consumers who knew the most about the price of milk made the greatest adjustment following price changes. Brinegar concluded that individual households tend either to make a major response or no response to price change.

Dwoskin *et al.* (4) in a study comparing average consumption change in Memphis, Tennessee, for a 6-month period in 1952 with average change for a 6-month period in 1953 found price elasticity to be −0.4. During this period, price declined an average of 1.8 cents per quart. In this study as in the Connecticut study, awareness on the part of homemakers of price declines was relatively low. Most homemakers were aware, however, that milk had been promoted during the year. The local producers' association and distributors conducted an advertising campaign during the period of declining prices. At the same time, a number of merchandising changes occurred in the market.

Consumption Response to Large Changes in Price

Some studies have indicated that consumers are more responsive to large changes in the retail price of fluid milk than to small price fluctuations. Since changes in the retail price of milk have usually been small, most price elasticities have been determined from these small fluctuations. Consumer response to small changes in price, as shown in most studies, has been small; that is, highly inelastic. Price-consumption data dealing with large retail-price changes from which price elasticities could be determined have been inadequate. Often large price changes were the result of "price-wars," occurring erratically and affecting only a part of the market.

Milk prices in Syracuse, Utica, and Binghamton, New York, rose 3 cents a quart in August, 1957, after these markets were included in the New York Federal Milk Order. This was one of the largest and most abrupt changes ever experienced in these areas. Analysis of the data by Jeffery and Feldman (6) was largely limited to the Syracuse market. In that market, the price of milk increased approximately 13 percent and sales dropped 9 percent. The average of seasonally adjusted sales for January

through May, 1957, was used in determining the quantities of milk sold before the price increase. It was found that sales in July, 1957, the last month before the price increase, were unseasonably low as compared with the seasonal sales pattern from 1951 to 1956. Sales in January through May, 1957, conformed closely with the seasonal pattern. Using the seasonally adjusted data for these months as a base, the coefficient of elasticity was found to be −0.8 for August, September, and December. In October it was −0.7 and in November −0.6.

Possible explanations of the greater response shown by the Syracuse study than by many previous studies were indicated as: (1) publicity accompanying and following the price increase; (2) an exceptionally large retail-price increase; and (3) more acceptable substitutes for fluid milk being available than previously.

In an experimental study among low-income families in Washington, D. C., in 1940, the price of milk was dropped from an average price greater than 12 cents to 5 cents a quart. The study was conducted by Stiebeling, Adelson, and Blake (12). They obtained per capita consumption for a given group of 192 white and 432 Negro families in two surveys. The first survey was taken before the price reduction and the second three months after the experiment was started. Results showed large per capita increases in consumption of fluid milk as well as in the use of other dairy products among families included in the experiment (Table 2).

Of the 624 families surveyed, both before and after the price reduction, only 321 participated in the low-price program at the time of the second survey. Consequently, the data in Table 2 refer only to the 321 participating families and do not include the response in milk purchases of the 303 families that did not buy the cheap milk.

Table 2. — Changes in Sales and Price of Fluid Milk for an Experimental Group, Washington, D. C., 1940[a]

Group	Total consumption of fluid milk, quarts per week		Average price per quart, cents		Elasticity[b]
	Before price decreases	After price decreases	Before price decreases	After price decreases	
White households					
72 purchasing milk before and after price decrease	498	1,014[c]	12.7	5.4	−0.8
102, including 30 not purchasing before price decrease	498	1,439	12.7	5.4	−1.2
Negro households					
104 purchasing milk before and after price decrease	762	1,821[c]	12.8	5.2	−1.0
219, including 79 not purchasing before price decrease	762	2,847	12.8	5.2	−1.5
All households					
212 purchasing milk before and after price decrease	1,260	2,835[c]	12.8	5.3	−0.9
321, including 109 not purchasing before price decrease	1,260	4,286	12.8	5.3	−1.4

[a] Source: Stiebeling, Adelson, and Blake (12).

[b] The price elasticities were calculated from the formula: $\frac{\log Q_2 - \log Q_1}{\log P_2 - \log P_1} = E$ where Q_1 = Total consumption before price decrease; Q_2 = Total consumption after price decrease; P_1 = Average price before price decrease; P_2 = Average price after price decrease.

[c] Based on the assumption that the families who were consumers of fluid milk prior to the price decline made the same response as all consuming families after price decline.

Among the 102 participating white families (identical families included in both surveys), consumption of milk nearly tripled, from a total of 498 to 1,439 quarts per week. The average price for the white families was 12.7 cents a quart before the price decline and 5.4 cents during the survey. The elasticity of demand with respect to price for these families was calculated to be −1.2 (Table 2). However, only 72 of the 102 white families were purchasing fluid whole milk before the price drop. For these 72 families, an elasticity of −0.8 was calculated on the assumption that the families who consumed milk prior to the price decline consumed their proportionate share of the milk used after the price decline.

The quantity of milk purchased by Negro families almost quadrupled after a price decline from 12.8 cents to 5.2 cents a quart. The price elasticity of demand for the 219 Negro families was calculated to be −1.5. For the 140 families purchasing milk before the price decline, consumption increased from 762 to an estimated 1,821 quarts a week, assuming these 140 families consumed the same average amount as the 219 families. For all households, both white and Negro, consumption increased from an average of 1,260 to 4,286 quarts a week following a reduction in price from 12.8 to 5.3 cents a quart; this is an elasticity of −1.4. For the 212 households that purchased milk prior to the price reduction, consumption increased an estimated 125 percent for an elasticity of −0.9.

A very limited application may be made of the results of the Washington study. The families included were not representative of the low-income group. Furthermore, it is likely that nutrition was a real problem for most of the families in the survey.

Based on findings of the Michigan State University Consumer Panel for an 8-year period, Quackenbush (8) concluded that price changes did not induce consumption changes to any significant degree. During 1955-1956 the weighted average price paid by consumers increased 3.2 cents a quart, or about 17 percent. Milk purchases declined very little during this period. He stated that families that made certain arrangements to buy lower-priced milk or to reduce the price they paid for fresh milk apparently consumed more. After such arrangements were made, price changes had little effect on consumption.

Conclusion

Although most of the literature dealing with consumer response to changes in the retail price of milk shows a highly inelastic demand, there are indications that in some instances consumers do make substantial adjustments to price changes. In determining consumer response to price fluctuations, it is difficult, if not impossible, to isolate the effect of price alone on consumption. This is perhaps a major reason for diverse findings in different studies. In the studies reviewed, it was often said that other variables associated with price changes may have been responsible for the adjustments or lack of adjustments in the use of milk. Most studies relating consumption response to small changes in price have shown a highly inelastic demand. In a few instances where price changes were small, consumers have materially altered consumption, but the response has still been inelastic.

As price competition in the dairy industry grows, it is likely that consumer response to price changes will grow. Increased price competition in many markets has resulted from the popularity of lower-priced milk sold through grocery stores. New fluid milk substitutes, such

as dry whole milk and concentrated milk, are likely to have a further effect on consumer response to price.

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Floriculture Sales in Mass-Market Outlets

ROSS A. KELLY

THE INCREASED COMPETITION of cut flowers grown out of doors in the south and west is a major concern of the northern greenhouse producers whose costs of production are normally much higher. On the other hand, the production of potted plants, because of their bulkiness and relatively high shipping costs, has less tendency to shift to producing areas long distances from consuming centers. Potted plants are becoming more important to the florist producer as a result of variety stores, supermarkets, and other mass-market outlets becoming prominent retail distributors for these low-cost products. Therefore production of potted plants seems likely to become increasingly important to the greenhouse operators located near northern population centers.

Objectives and Scope

The underlying premise of this study was that total sales of inexpensive potted plants and bunches of cut flowers could be increased if they were offered for sale in mass-market outlets. Specific objectives were:

1. To test consumer acceptance of cut flowers and potted plants offered for sale in selected mass-market retail outlets.

2. To recommend procedures for applying results to other flowers, plants, and outlets.

The scope was limited to small potted

plants and small bunches of cut flowers because (1) these are grown in Illinois and can compete successfully with out-of-state products; (2) the demand for these products is elastic (that is, as price declines gross revenue increases); (3) they are satisfactory for everyday use and inexpensive gifts; and (4) they are relatively easy to handle in retail outlets.

The scope was limited to variables that could be controlled in the stores. Included were retail price, the relative quality of the displays between the outlets, size of display area, and kinds of plants displayed.

Experimental Procedure

During 1955-56 the experiment was conducted from November 7 to April 14; in 1956-57 from October 10 to May 11; and in 1957-58 from December 10 to May 10, with the exception of inventory periods during the last two weeks in December which had an undetermined effect on sales during this period. The same supermarket, variety store, and retail floral shop were used during the three periods. The floral shop was used as a check on the results of the sales in the mass-market outlets.

The plants were delivered to the stores on consignment, which permitted control of the factors being studied and removal of plants.

During 1955-56 the chrysanthemum plants displayed were in 3-inch standard clay pots. For better display and ease of watering, the clay pots were inserted into 4-inch green, paper-maché pots. The plants were placed in polyethylene bags, which were held around the lower part of the pot with an elastic band. To eliminate the effect of various packaging techniques on rate of sale and to reduce labor cost, no packing was done the second and third years, and the paper-maché container was eliminated.

The cut chrysanthemums were packaged in polyethylene bags each year. The size of the bunches was equivalent to six carnations regardless of the number of chrysanthemum stems needed. The bags were fastened around the lower part of the stems with paper-covered wire or elastic bands.

During 1956-57 asters, begonias, calceolarias, potted and bunched chrysanthemums, cinerarias, coleus, cyclamen, kalanchoes, poinsettias, and primula were displayed for periods varying from two weeks to throughout the entire period. The third year the kinds were reduced to begonias, calceolarias, potted and bunched chrysanthemums, cinerarias, coleus, cyclamen, poinsettias, schizanthus, and arrangements. The length of time displayed varied as in the preceding year.

Displays and Equipment

Displays were not alike in every respect at all times, but were comparable in area, number of varieties on display, number of plants on display each morning, price per unit, and general quality. Various means of display were used. The most successful for the cut flowers was a fiberboard box inverted over a watertight pan. Holes were cut in the fiberboard, and metal tubes secured to the underside to hold the flowers upright. The potted plants were kept fresh the first year by putting water in the paper-maché pots. During the next two years, the plants were displayed in metal or clay pans, which needed about 2 inches of water a day for evaporation and plant requirements.

Trend in Weekly Sales

In 1955-56 the trend in weekly sales at the supermarket began rising after January 2 and continued upward through the remainder of the period (Figure 1). In comparison, the sales trend at the

other mass outlet rose slightly until January and then declined. The sales trend at the floral shop increased gradually until about mid-February, then leveled off.

The sales trend lines in the supermarket and variety store were almost reversed the second year (Figure 2) declining in the former after mid-February, and rising steadily in the variety store. Even though sales at the floral shop increased from the first to the second season, the trend was quite similar.

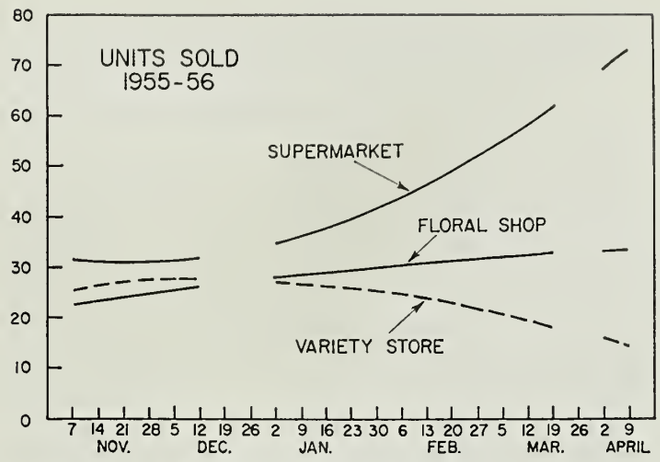

Fig. 1. — Trend in weekly sales, 1955-56.

During the third season the sales' trends in the mass markets were nearly identical (Figure 3) until the last few weeks, when sales at the supermarket began leveling off. The trend in the floral shop was similar to that of the two preceding years, but rose at a slightly faster rate.

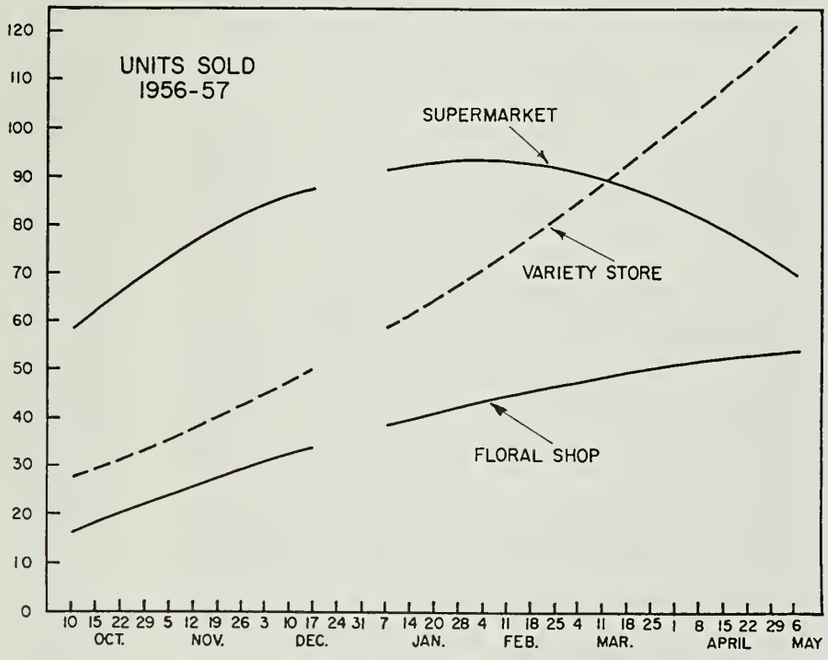

Fig. 2. — Trend in weekly sales, 1956-57.

Total Sales

During the three years 11,496 plants and bunches were sold through the three outlets. Approximately 41 percent were sold at the supermarket, 36 percent at the variety store, and 23 percent at the florist shop. Although the total number of plants sold through the variety store was not as great as through the supermarket, the trend in sales indicated that the variety store was an increasingly acceptable outlet for floricultural products, rising 15.5 percent during the three years.

Even though the florist shop moved locations each year with each move resulting in less walk-in trade, sales of the inexpensive cash-and-carry items used in the experiment held up remarkably well, indicating a possibility for increased total sales.

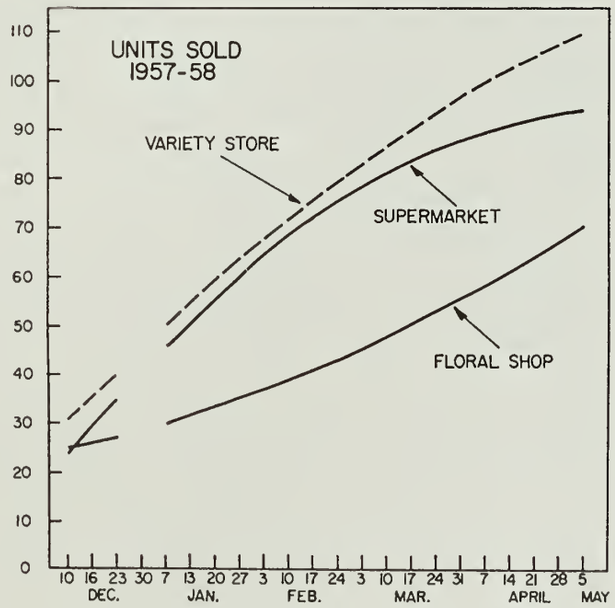

Fig. 3. — Trend in weekly sales, 1957-58.

Average Weekly Sales

Weekly sales per store averaged 64 units in 1956-57 and 1957-58 compared with 32.5 the first year, an increase of nearly 97 percent (Table 1). The variety store had the greatest increase in volume between the first and second year, 191 percent, compared with 86 percent at the supermarket and 35 percent at the florist shop. Average weekly sales increased further at the variety store and floral shop the third year, but the volume at the supermarket declined 15.5 percent.

Table 1. — Average Weekly Sales of Floricultural Products by Outlet, 1955-56, 1956-57, and 1957-58

Outlet	1955-56 (20 weeks)	1956-57 (29 weeks)	1957-58 (21 weeks)	Total (70 weeks)
	Total sales			
Supermarket..	889	2,395	1,466	4,750
Variety store..	478	2,017	1,610	4,105
Florist.....	584	1,145	951	2,680
Total.....	1,951	5,557	4,027	11,535
	Average sales per week			
Supermarket..	44.5	82.6	69.8	67.9
Variety store..	23.9	69.6	76.7	58.7
Florist.....	29.2	39.5	45.3	38.3
Total.....	32.5	63.9	63.9	54.9

Variations in Total Weekly Sales

An effort was made to determine the influence of special occasions, holidays, competing products, introduction of new plants, and changes in display location on weekly fluctuations in sales.

Holidays and special occasions had the greatest effect on sales of any variable considered. At Thanksgiving, Christmas, Valentine's Day, Mother's Day, and Easter, sales usually increased several days before the event and were relatively low for at least one week afterwards. Sales of competitive products had no consistent continuous effect on sales of experimental plants and flowers, partly because of the types of competing plants, their size, and their price. Relatively few of the weeks during which there was a change in the location of the display were associated with changes in total weekly sales.

During 1955-56 the change from potted to bunched chrysanthemums had no appreciable effect on sales. In 1956-57 the introduction of poinsettias preceding the Christmas holiday and reintroduction of cinerarias before the Easter holiday were accompanied by increased sales. The introductions of cinerarias and of calceolaria in weeks following holidays were both associated with decreased sales. It appeared that total sales were generally larger when new types of plants were added to the display. Its value as a merchandising technique is difficult to determine because of the large variation in weekly sales as well as the substitution effect of the newly introduced flowers for those already on display.

Total sales of every kind of plant displayed, with the exception of coleus and bunched chrysanthemums, showed generally decreasing trends over the display period. This indicated that introducing new types of flowers at various time intervals would be a merchandising technique that would increase sales. The most advantageous interval to use would vary with the kinds of plants used and season of the year.

Comparative Returns

An analysis of the profitableness of the floricultural displays indicated the merits of inexpensive floricultural products as a sales item in mass markets. Gross retail margins on the various plants ranged from nearly 34 to 41 percent the

first year, from 33 to 49 percent the second year, and from 16 to 49 percent the third year, depending on the cost of the various items in retail prices which were set in line with the objectives of the project. This compares with gross profit rates a square foot in supermarkets of 17.94 percent in 1956, 18.11 in 1957, and 18.12 percent in 1958.[1] In 1958, three variety stores averaged 38 percent gross margin which was the same as that of the floricultural sales in that outlet for that year.[2] The florist indicated that the gross margin was somewhat less than that generally obtained on his cash-and-carry merchandise, but was about that obtained on his "specials." It was less than the 50.9 percent gross margin received by six retail florists in Pennsylvania.[3]

Data published by the Super Market Institute show that weekly sales in supermarkets during 1956, 1957, and 1958 were $3.95, $3.77, and $3.71 a square foot of sales area.[4] Sales of experimental flowers and plants were well above these averages (Table 2). Unfortunately comparable data were not available for either variety stores or floral shops.

Gross profits per square foot of selling space in supermarkets were $.71 in 1956, $.68 in 1957, and $.67 in 1958. This compares with $3.18, $3.13, and $2.61 a square foot for floricultural products for the three periods of the experiment. The floricultural display had the desirable characteristics of high margins, fast turnover, and above-average profits as measured by relatively high weekly sales and returns per square foot of display space in the supermarket. Although comparable data are not available for the other stores, it is assumed that the high rate of sale and estimated gross profits would make such plants and flowers a profitable use of selling area in such outlets.

Shrinkage was a major problem, being larger under the experimental conditions than it would have been under normal retail operations. Nevertheless, after adjusting gross profit by the cost of the flowers and plants removed for all reasons, the supermarket still had an adjusted gross profit of $1.15 a square foot a week, the variety store $1.38, and the florist $.68.

Table 2. — Gross Returns and Profits per Square Foot of Display Space for Floricultural Products by Outlet, 1955-56, 1956-57, and 1957-58

Outlet	Area of display	Sales per sq. ft.	Gross profit per sq. ft.
	(sq. ft.)	(per week)	
1955-56, 20 weeks			
Supermarket	3.75	$8.83	$3.18
Variety store	3.75	4.25	1.52
Florist	3.75	5.55	2.00
Average	3.75	6.21	2.24
1956-57, 29 weeks			
Supermarket	7.5	$9.02	$3.13
Variety store	7.5	6.96	2.59
Florist	7.5	4.30	1.51
Average	7.5	6.76	2.41
1957-58, 21 weeks			
Supermarket	7.5	$7.30	$2.61
Variety store	7.5	7.60	2.76
Florist	7.5	4.79	1.69
Average	7.5	6.56	2.35

[1] *The Super Market Speaks.* 11th Annual Report of the Super Market Institute, p. 11. 1959.

[2] *The Big Challenge in Food Marketing.* 8th Biennial Grocery Study, p. 17. This Week Magazine. 1959.

[3] Pfahl, P. D., Trotter, C. E., and Pease, R. W. *Merchandising for Profit in Retail Flower Shops.* Pa. Agr. Exp. Sta. Bul. 659, p. 13. 1959.

[4] *The Super Market Speaks,* p. 12.

This study is reported in more detail in a Station Bulletin of the same title, now in press.

Short-Run Crop Acreage Adjustments in Illinois

EARL R. SWANSON

BY THEIR INDIVIDUAL DECISIONS, Illinois farmers collectively determine the use of the agricultural land in the state. Each crop competes with its alternatives in the selection of a cropping system. Each year there is opportunity for farmers to revise crop-acreage plans in response to changes in expectations concerning prices and costs, yields, government programs, and other considerations. In this article the year-to-year acreage changes for principal crops in Illinois are examined and, based on this experience, a model is developed to analyze the acreages of crops planted in 1960.

Crop Acreage Changes, 1940-1959

During this 20-year period, six crops — corn, soybeans, oats, wheat, hay, and plowland pasture — occupied, on the average, nearly 70 percent of the land on Illinois farms (Table 1). The variation in the percentage of other uses of land among crop-reporting districts (Figure 1) is chiefly due to differences in the percentages of nontillable land rather than the presence of other grain crops. Looking at the trend for the 20-year period for the state as a whole, we see that increases in acres of corn and soybeans have come largely at the expense of plow-

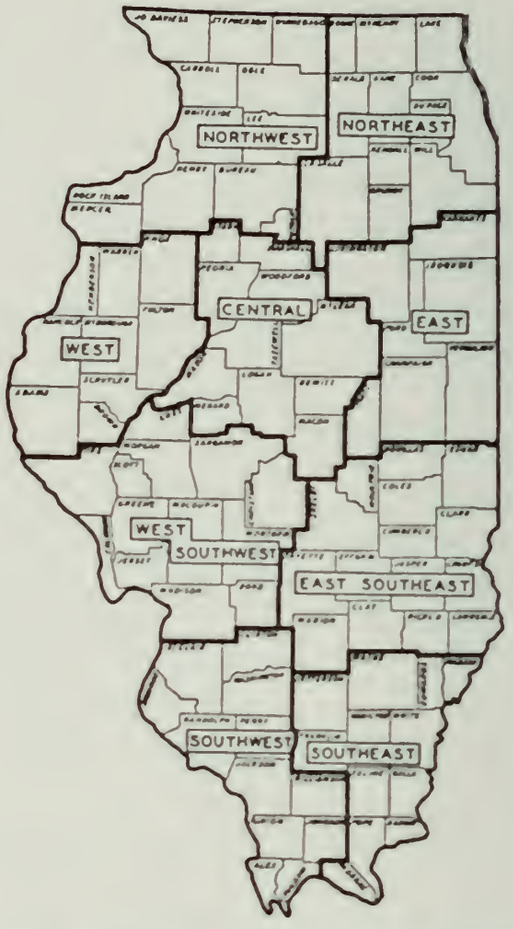

Fig. 1. — Illinois crop-reporting districts.

Table 1. — Percent of Total Area in Farms Occupied by Each of Six Crops, 1940-1959 Average[a]

Crop-reporting district	Corn	Soybeans	Oats	Wheat	Hay	Plowland pasture	Other uses
				(percent)			
Northwest	32.2	3.3	17.3	.6	12.0	8.4	26.2
Northeast	35.3	7.4	19.3	.8	11.4	6.0	21.8
West	25.9	9.9	10.3	4.1	8.4	5.3	38.7
Central	34.3	15.0	13.6	4.4	7.6	5.1	21.8
East	36.9	20.3	15.5	2.6	5.7	5.9	16.6
West southwest	23.8	17.3	5.7	9.7	6.6	5.1	34.7
East southeast	23.4	20.1	5.3	6.5	8.2	8.4	29.8
Southwest	16.5	9.4	4.7	13.5	8.8	7.1	42.7
Southeast	17.6	8.2	2.0	6.0	7.6	13.2	46.8
State	27.9	12.7	10.7	5.2	8.6	7.1	30.7

[a] Illinois Agricultural Statistics and Illinois Assessors Census for the years indicated. Data are estimates of harvested rather than planted acres.

land pasture, oats, and hay (Figure 2). However, our focus in this report is on the short-term crop acreage changes that occur when one year is compared with the immediately preceding one.

Importance of Acreage Shifts in Year-to-Year Production Variation

Changes from one year to the next in total production of a crop are due to changes from the previous year in total acreage planted in that crop and changes in the yield per acre planted. An analysis of the relative importance of these two changes for the four major grain crops is presented in Table 2. The method employed divides the average year-to-year change in production into its two component parts — acreage and yield. As an example consider corn in the northwest crop-reporting district. On the average over the 20-year period, a 1-percent change in production from the previous year was composed of 0.13-percent change in planted acres and 0.87-percent change in yield. In general, the contribution of acreage changes is relatively small for major crops. Only in a few cases (soybeans in the northwest and northeast districts, oats in the southeast district, and wheat in the northeast, west, and east districts) are the year-to-year acreage changes more important in influencing crop production than the year-to-year yield changes. In these instances the crops are not major crops in their respective districts (Table 1).

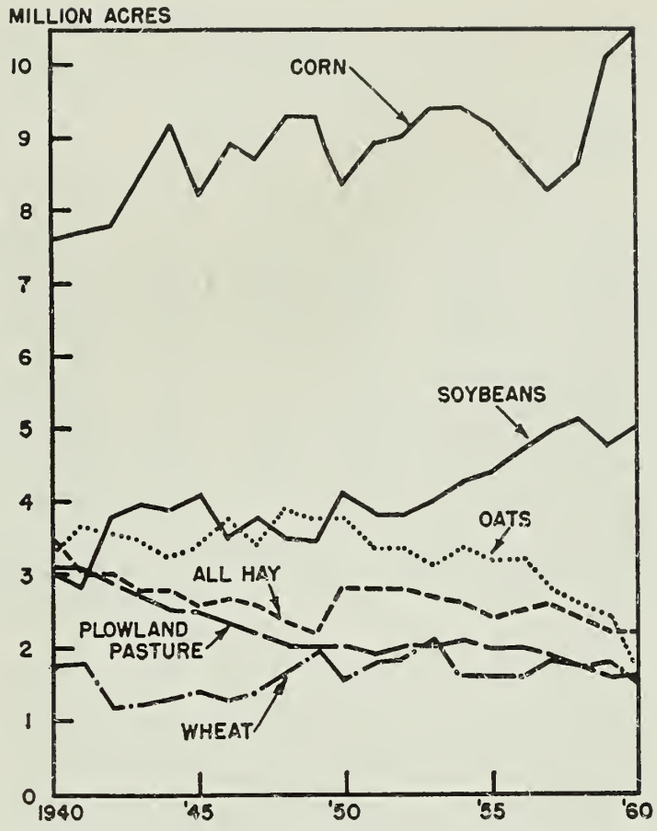

Fig. 2. — Planted acres of principal grain crops, acres of hay harvested, and plowland pasture in Illinois.

Regarding corn, the districts showing the greatest importance of acreage shifts

Table 2. — Average Contribution of Acreage and Yield Changes to a 1-Percent Change in Crop Production From Preceding Year, Principal Grain Crops, Illinois, 1940-1959[a]

Crop-reporting district	Corn		Soybeans		Oats		Wheat	
	Acreage	Yield	Acreage	Yield	Acreage	Yield	Acreage	Yield
	(percent)							
Northwest	.13	.87	.65	.35	.07	.93	.30	.70
Northeast	.05	.95	.57	.43	.09	.91	.52	.48
West	.18	.82	.16	.84	.37	.63	.58	.42
Central	.14	.86	.48	.52	.15	.85	.30	.70
East	.12	.88	.21	.79	.10	.90	.56	.44
West southwest	.10	.90	.11	.89	.31	.69	.45	.55
East southeast	.23	.77	.05	.95	.45	.55	.39	.61
Southwest	.21	.79	.10	.90	.47	.53	.20	.80
Southeast	.26	.74	.17	.83	.54	.46	.26	.74
State	.18	.82	.15	.85	.22	.78	.32	.68

[a] For the method of computation see S. M. Sackrin, "Measuring the Relative Influence of Acreage and Yield Changes on Crop Production." *Agricultural Economics Research* 9:136-139. 1957.

Table 3. — Acreage Adjustments of Principal Illinois Crops Expressed as Average Percentage Increases or Decreases From Preceding Year, 1940-1959[a]

Crop-reporting district	Corn		Soybeans		Oats		Wheat		Hay		Plowland pasture	
	Inc.	Dec.	Inc.	Dec.	Inc.	Dec.	Inc.	Dec.	Inc.	Dec.	Inc.	Dec.
	(percent)											
Northwest....	4.2(12)[b]	−2.1(7)[b]	17.4(9)	−14.7(10)	2.5(9)	−3.3(10)	12.3(9)	−14.1(10)	4.1(8)	−3.9(11)	2.0(6)	−4.2(13)
Northeast....	4.3(10)	−2.4(9)	19.0(8)	−10.0(11)	2.5(8)	−4.9(11)	17.4(11)	−14.2(8)	2.5(9)	−4.5(10)	5.4(6)	−5.3(13)
West.....	7.7(11)	−5.4(8)	9.7(11)	−10.3(8)	14.2(8)	−9.1(11)	19.0(9)	−13.5(10)	17.7(8)	−12.0(11)	5.4(8)	−7.5(11)
Central.....	6.1(12)	−5.5(7)	15.5(9)	−9.0(10)	6.0(9)	−6.9(10)	13.0(10)	−15.3(9)	11.6(8)	−8.8(11)	4.6(7)	−7.5(12)
East.....	4.7(12)	−4.9(7)	10.6(10)	−7.6(9)	5.8(7)	−6.8(12)	25.4(12)	−19.2(7)	12.7(6)	−7.6(13)	6.4(6)	−7.6(13)
West southwest.....	8.8(12)	−8.2(7)	11.7(11)	−6.7(8)	26.3(6)	−13.3(13)	10.7(12)	−17.4(7)	12.1(7)	−11.4(12)	6.3(4)	−7.8(15)
East southeast.....	9.1(12)	−10.4(7)	7.8(11)	−3.2(8)	20.4(9)	−19.5(10)	14.7(14)	−18.8(5)	14.4(4)	−10.3(15)	3.0(3)	−6.2(16)
Southwest.....	12.4(10)	−8.2(9)	15.3(16)	−4.7(3)	29.4(6)	−15.6(13)	6.9(9)	−9.1(10)	7.4(7)	−6.9(12)	6.7(8)	−8.4(11)
Southeast....	7.5(13)	−10.0(6)	12.6(15)	−8.2(4)	51.7(6)	−22.4(13)	11.8(13)	−15.4(6)	9.4(4)	−7.8(15)	7.4(5)	−7.3(14)
State....	6.2(11)	−5.4(7)	9.2(11)	−5.6(8)	10.4(5)	−6.1(13)	8.7(13)	−17.8(6)	7.1(7)	−5.7(12)	2.3(5)	−5.4(14)

[a] Data are based on planted acres of the grain crops, harvested acres of hay, and the land reported in plowland pasture irrespective of its use.
[b] Numbers in parentheses indicate the number of year-to-year increases or decreases entering the average percentage change presented. For the state as a whole, there was no change in the planted acres of corn from 1953 to 1954 and of oats from 1955 to 1956.

(east southeast, southwest, and southeast) are those in which corn is less important in relation to other crops than in the northern two-thirds of the state. A factor working in the opposite direction is that of yield variability due to weather. In general, the southern portion of the state experiences greater yield instability.[1]

For the state as a whole, year-to-year changes in yield have been substantially more influential than changes in planted acres in determining production changes. Yield changes have been roughly four times as important as acreage changes for corn and oats; six times as important for soybeans; and three times as important for wheat (Table 2).

The Degree of Year-to-Year Acreage Adjustment

One measure of the willingness of farmers to adjust acreages to changes in the conditions under which cropping plans are developed, is the extent to which crop-acreage adjustments have been made in the past. The percentage acreage adjustments in Table 3 are divided into those years in which planted acres increased from the previous year, and those years in which decreases occurred. For example, for the northwest district, corn acreage increased over the previous year 12 times, but decreased only seven times. For the years in which increases occurred, the increase in planted corn acres was, on the average, 4.2 percent; for years in which decreases occurred, the average decrease was 2.1 percent. In general, the major crops show less tendency for pronounced year-to-year percentage shifts in acreage.

The average percentage changes in Table 3 obscure some substantial shifts in planted acres in individual years. In response to wartime incentives, the state acreage of corn increased 8 percent from 1942 to 1943 and 9 percent from 1943 to 1944. These increases are well above the average of 6.2 percent for the years in which increases occurred. However, the largest percentage increase (16.1) in planted corn acres occurred from 1958 to 1959, when corn acreage allotments were lifted after having been in effect for five years. Although all districts increased acres of planted corn, the central district and the west-southwest district led the increases with 22.2 and 22.0 percent, respectively.

The two substantially above-average

[1] Earl R. Swanson, *Variability of Yields and Income From Major Illinois Crops, 1927-1953.* Ill. Agr. Exp. Sta. Bul. 610. 1957.

reductions in planted acres of corn were from 1944 to 1945 (10.6 percent for the state) and from 1949 to 1950 (10.0 percent for the state). It is interesting to compare these reductions with those occurring under the current feed-grain program. In 1945 wet weather delayed planting and on June 7 only about 80 percent of the intended corn crop had been planted. In the southern and western parts of the state, the planting season was one of the most unfavorable ever experienced. Acres of corn planted dropped 11.6 percent in the west district and over 20 percent in each of the four southern districts. Partly as a consequence, soybean acreage planted increased by nearly 5 percent for the entire state after being offset by decreases in soybean acres in the northwest, northeast, and east districts.

From 1949 to 1950 the reduction in corn acreage was at least partly in response to the introduction of acreage allotments for the first time since 1941. There was considerable variation among districts in the percent of reduction. The districts across the central part of the state (west, central, and east) all experienced approximately a 15-percent reduction in planted acres compared with the state average of 10 percent. At the other extreme, in which the allotment program was apparently of very minor importance, the southeast district actually increased planted acres of corn by about 1 percent.

As in 1945 the reduction in corn acreage was associated with an increase in acres of soybeans planted. For the state, corn acres planted were reduced about 928,000 acres and soybean acres increased about 641,000 acres. This represents a percentage increase in soybeans planted of 18.5 percent from 1949. During the 20-year period this increase in planted acres of soybeans has been exceeded only once — in 1942 — when acres of soybeans planted increased 34.0 percent in response to wartime demand and to a substantial reduction in acreage of winter wheat. Wheat entered the winter of 1941-42 in below-average condition. Unfavorable weather during the winter resulted in a heavy loss of seeded acreage in the central and lower west-central parts of Illinois. Abandonment occurred at about twice the normal rate. Further, the AAA acreage allotments for wheat in 1942 had been reduced.

Also associated with the corn-acreage reduction from 1949 to 1950 was a large percentage increase in acres of hay harvested. The increase of 27.4 percent was the largest change, either increase or decrease, from the previous year recorded for that crop during the 20-year period.

One other abrupt change from a previous year deserves mention. From 1945 to 1946 acres of soybeans planted dropped about 14 percent for the state. All districts had decreases except the southeast and southwest. The acreage goals set by the federal government in early 1946 called for an increase of 150,000 acres of soybeans in Illinois. The base support price was $2.04 a bushel with the ceiling price 6 cents a bushel above at $2.10. However, on May 13, 1946, the price ceiling on corn was raised 25 cents a bushel, from $1.10 to $1.35 a bushel. The ceiling price of soybeans was not raised to correspond to its normal relationship to the new corn price. Thus the competitive position of corn improved substantially, and this was an important factor in the drop in soybean acres in 1946.

The percentage changes in Table 3 represent responses to many different kinds of changes in the setting in which farmers decide on a cropping program — price-cost relationships, government programs, improved technology, etc. Although the historical average percentage changes in acres summarize a reaction to

a mixture of events, they may serve as a guide for setting limits within which short-run adjustments to changed economic variables might be expected to occur from any given year to the next.

Prediction of 1960 Crop Plantings

A simple model was constructed to indicate the crop plantings for 1960 based on information available at the end of the 1959 crop season.[2] The objective of farmers is assumed to be maximization of return above direct costs. Upper and lower limits on adjustment from 1959 planted acreages for each crop were assumed to reflect the average behavior of farmers since 1940 (Table 3). Wheat acreage allotments for 1960 were also considered.[3] In addition, the total acres in the six crops — corn, soybeans, oats, wheat, hay, and plowland pasture — were assumed to be the same in 1960 as in 1959.

In planning the cropping system for the ensuing year, farmers are assumed to base their yield expectation on the average for the last five years (Table 4). Since we are dealing with rather short-term planning, only the direct costs of planting, cultivating, and harvesting are considered relevant. The best estimates of prices for the 1960 crop at planting time are assumed to be the 1959 season average prices. For the state as a whole, these prices were as follows:

Corn	$ 1.08 per bushel
Soybeans	2.10 per bushel
Oats	0.65 per bushel
Wheat	1.75 per bushel
Hay	18.00 per ton
Plowland pasture	0.13 per pasture day

Expected returns per acre for the crops for each district are given in Table 5.

A separate analysis was performed for each crop-reporting district. The predicted acreages appear in the first column of Table 6. The planted acreages estimated from the annual survey of intentions to plant are in the second column. In comparison with the actual plantings (third column of Table 6), the method described in this report correctly predicted the direction of acreage change for each crop. However, it overesti-

Table 4. — Five-Year Average Yields per Harvested Acre, Illinois, 1955-1959[a]

Crop reporting district	Corn	Soybeans	Oats
	bu.	*bu.*	*bu.*
Northwest	73.0	28.8	52.0
Northeast	67.4	28.0	51.8
West	68.8	27.3	44.0
Central	70.9	29.1	46.7
East	67.1	28.3	44.2
West southwest	63.1	27.1	42.2
East southeast	56.6	24.0	38.5
Southwest	44.7	21.5	32.1
Southeast	44.7	21.0	28.3
State	64.4	26.3	47.4

	Wheat	All hay	Pasture[b]
	bu.	*tons*	*pasture days*
Northwest	31.8	2.30	128
Northeast	34.6	2.28	127
West	30.0	1.93	108
Central	32.5	1.92	107
East	34.0	1.93	108
West southwest	31.6	2.04	114
East southeast	27.8	1.53	85
Southwest	27.3	1.71	95
Southeast	24.9	1.28	71
State	29.6	1.98	110

[a] Source: Illinois Agricultural Statistics.
[b] Estimated from hay yields.

[2] For details of method employed see James M. Henderson, "The Utilization of Agricultural Land: A Theoretical and Empirical Inquiry." *The Review of Economics and Statistics* 41:242-259. 1959.

[3] Because farmers can grow 15 acres of wheat without an allotment, there is usually an excess of planted acres over the allotment for an area. In 1959 for the state as a whole, the total planted acreage exceeded the allotment by 25 percent. There was considerable variation in overplanting from district to district. To determine the upper limits for the analysis, the smaller of the following was taken: (a) the district wheat allotment plus a percentage of 1960 allotment that was the same as the percentage of excess planted acres in 1959 or (b) the average historical percentage increase for years in which increases occurred (Table 3).

Table 5. — Returns per Acre Above Variable Costs[a]

Crop-reporting district	Corn	Soybeans	Oats
Northwest	$48.00	$40.76	$17.66
Northeast	44.98	40.04	18.59
West	44.22	38.38	13.42
Central	48.24	42.22	14.85
East	44.03	40.35	13.97
West southwest	39.09	37.45	13.31
East southeast	33.24	31.40	11.27
Southwest	22.98	26.31	7.76
Southeast	22.98	25.13	5.67
State[b]	41.46	33.43	15.64

	Wheat	Hay	Plowland pasture
Northwest	$36.16	$27.11	$14.23
Northeast	40.78	24.03	14.12
West	33.40	16.08	12.02
Central	37.55	16.12	11.91
East	39.86	18.40	12.02
West southwest	35.85	17.11	12.69
East southeast	29.20	11.03	9.45
Southwest	28.72	14.17	10.56
Southeast	24.60	5.87	7.89
State[b]	32.55	18.66	9.37

[a] Based on average yields 1955-1959 (see Table 4) and 1959 season average prices. Variable costs for grain crops include fuel, repairs, seed, fertilizers, and labor. See R. A. Hinton, *Farm Management Manual*, AE-3349 (mimeo), Department of Agricultural Economics, University of Illinois, 1959. Variable hay costs include harvesting costs and a charge for fertility removed. Pasture cost includes only a charge for fertility removed.

[b] Weighted by 1959 acreages.

Table 6. — Predicted Acres, Intention to Plant, and Actual Planted Acres, Illinois, 1960

	Predicted with 1959 prices[a]	Survey of farmers' intention to plant[b]	Actual plantings[c]
Corn			
Acres (1,000)	10,721	10,362	10,323
Percent of 1959 planted acres	107	103	103
Soybeans			
Acres (1,000)	4,803	4,960	5,013
Percent of 1959 planted acres	101	104	105
Oats			
Acres (1,000)	2,194	2,169	1,842
Percent of 1959 planted acres	93	92	78
Wheat			
Acres (1,000)	1,527	1,724	1,635
Percent of 1959 planted acres	86	97	92

[a] These acreages were predicted with the method described in the text.

[b] CROPS, Illinois Cooperative Crop Reporting Service, March, 1960.

[c] CROPS, Illinois Cooperative Crop Reporting Service, March, 1961.

mated corn and oat plantings and underestimated soybean and wheat acreages. The results of the method employed might have been more accurate with respect to corn and soybeans if unfavorable weather at corn-planting time had not occurred, causing soybeans to be a better risk. The oats acreage predicted, and the results of the survey of intentions to plant were in excess of the actual acreage planted, which was the lowest in the state since 1881. The excessive delay in the seeding of oats caused by the unfavorable weather was undoubtedly a factor. Virtually no oats had been seeded by the first of April, by which time one-third of the acreage is normally sown.

The total acreage in the four grain crops that was predicted by the model represented an increase of 1.5 percent over the 1959 planted area. This compares with an actual decrease of 0.8 percent estimated by the Illinois Cooperative Crop Reporting Service.

Pressures for Crop Adjustment

The solutions for each district also give information on the relative pressures for increases and decreases for each crop. It will be recalled that the assumed limits on individual crop acreage adjustments are the historical average shifts (Table 3), and for wheat the acreage allotment with certain additional acres allowed for farmers planting within the 15-acre exemption. These limits on adjustment, together with the restriction that the total acres in the six crops in 1960 was to be the same as that in 1959, imply in the districts studied that five of the six crops will have acreages at either the upper or lower limit on adjustments applicable to that particular crop. One of the six crops will have

an expected planting somewhere between its upper and lower limit on adjustment. The return above variable cost (Table 5) for this "floating" crop gives an indication of the increase in income that would be received from an additional acre of cropland under the conditions that the individual crop adjustment limits remain effective. In all districts, except the southwest and southeast, the predicted 1960 soybean acreage is neither at the upper nor at the lower limit of adjustment. Predicted 1960 corn acreages are neither at their upper nor their lower limit in the southwest and southeast districts.

The competitive strength of corn is shown by its 1960 predicted acreage being consistently at the upper limit of expansion in all except the southwest and southeast districts. Further, the only other crops pressing against their upper limits on adjustment were wheat in the northeast, southwest, and southeast districts and soybeans in the southwest and southeast districts. Oats, hay, and plowland pasture decreased the limit permitted by the model in all districts.

Effect of Varying Corn Price on Estimated 1960 Acreage

The corn price used in calculating the returns in Table 5 and in predicting the planting in 1960 (Table 6) was the 1959 season average, which for Illinois was $1.08 per bushel. It is of interest to estimate the response of farmers to

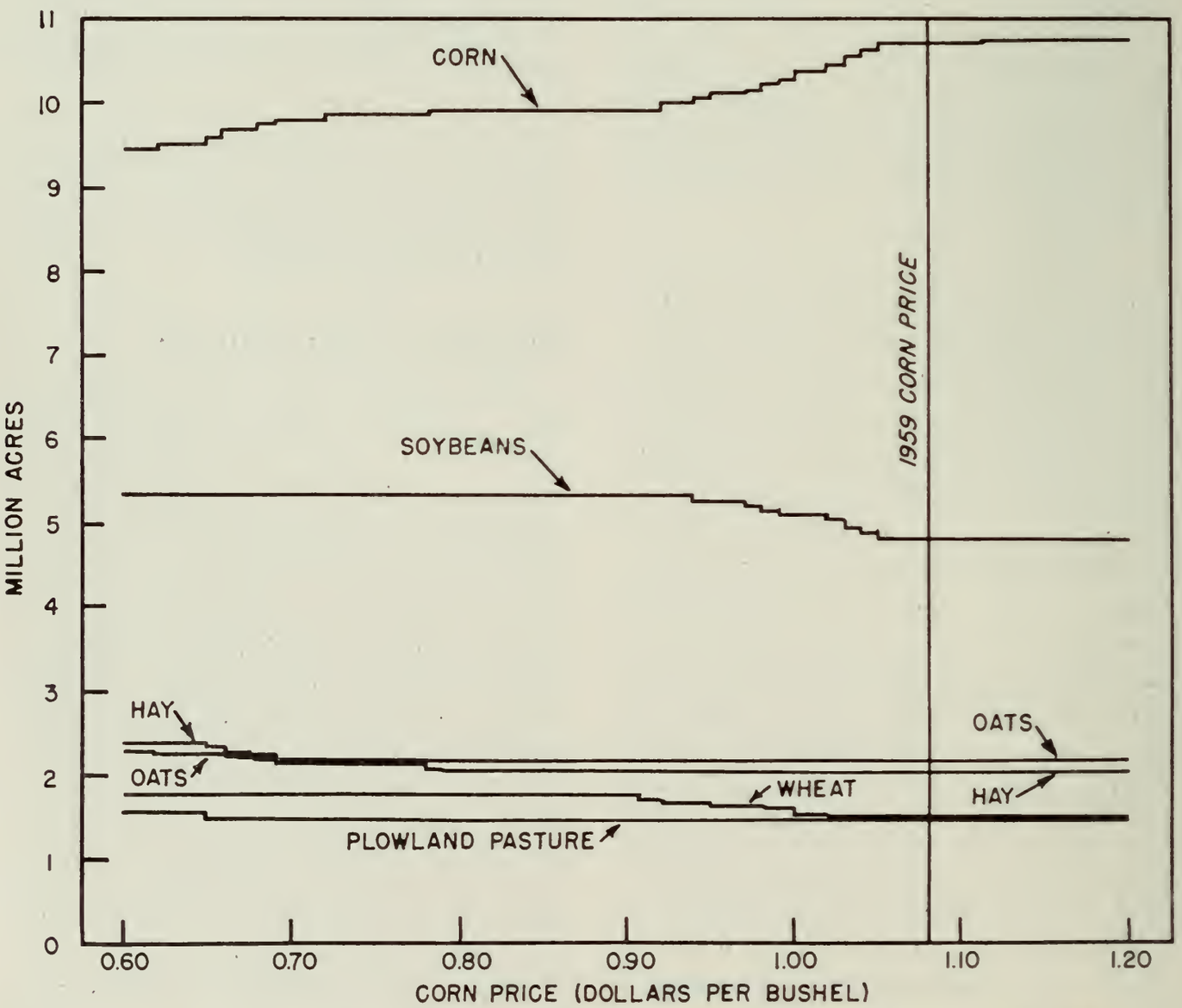

Fig. 3. — Predicted Illinois crop acreages with various expected corn prices, 1960.

changes in the expected corn price. This analysis gives an evaluation of the competitive strength of corn in Illinois crop production.

Calculations were made for each crop-reporting district, with the expected corn price for the 1960 crop varying from 60 cents to $1.20 per bushel and the other crop prices remaining at their 1959 season average. The results are presented in Figure 3. The vertical line represents the predicted acreages with the corn price at its 1959 season average. Since it was assumed that the total acreage in the six principal crops was to remain the same in 1960 as in 1959, as the price of corn was increased from 60 cents per bushel, there were shifts in acres from other crops to corn (Figure 3). These shifts in acres planted occur at "break-even" corn prices, which vary from crop to crop as well as from district to district (Table 7). The first shift occurs at 62 cents when corn displaces oats in the west district. Note that oat acreage decreases by the amount of the corn acreage increase. The next increase in corn acreage is at 65 cents, when corn again substitutes for oats, this time in the northwest district. Since the total amount of land used for these six crops in 1960 must be the same as that in 1959, in some districts soybeans, wheat, and hay were sufficiently profitable relative to oats to force the oat acreage to decrease to its lower limit of change from 1959. This was true in the northeast, central, east, southwest, and southeast districts. Thus even though all of the break-even prices for corn when it is compared with oats are above 60 cents (Table 7), there are only four increases in corn acreage due to decreases in oat acreage as we increase the corn price from 60 cents.

A plateau in corn acreage occurs between the corn prices of 79 cents and 91 cents per bushel. At 79 cents corn has forced oats, hay, and plowland pasture to their maximum decreases. As the corn price increases above 91 cents, soybean and wheat acreages are gradually decreased until the corn price reaches $1.21, at which point it achieves its maximum permitted acreage increase.

If the expected corn price for 1960 had been 90 cents instead of the assumed 1959 price of $1.08, corn acreage would have been reduced only about 7 percent. On the other hand, an increase to $1.21 would have increased acreage in corn less than 0.5 percent. These estimates probably underestimate the response in bushels produced. In this analysis, only the reallocation of the land resource in response to changes in price expectations is considered. Practices affecting yield per acre, such as fertilization, may also be altered in response to changed price expectations.

Table 7. — Corn Prices Necessary for Return Above Variable Costs to Be Equal to That of Other Selected Crops[a]

Crop-reporting district	Soybeans	Oats	Wheat	Hay	Plowland pasture
	(dollars per bushel for corn)				
Northwest	.97	.65	.91	.78	.61
Northeast	1.03	.71	1.04	.79	.64
West	.99	.62	.91	.66	.60
Central	1.02	.63	.95	.65	.59
East	1.04	.64	1.03	.71	.61
West southwest	1.04	.66	1.02	.72	.65
East southeast	1.04	.68	1.00	.68	.65
Southwest	1.15	.74	1.21	.88	.80
Southeast	1.13	.69	1.12	.70	.74
State[b]	1.02	.66	1.04	.74	.66

[a] See Table 5. Other crops are assumed to sell at 1959 average prices.
[b] Weighted by the 1959 total acres in the six crops in each district.

Summary

Adjustments in the acreages of crops planted reflect changes in the expectations of farmers concerning crop production. Although year-to-year changes in planted acres are substantially less important than year-to-year changes in yields in terms of influencing production, acreage changes are under control of the

individual farmer. An analysis of the changes in planted acres indicates that the acreages of major crops in an area have not shifted as much as the minor crops when adjustments are stated in terms of percentage changes from the previous year. Several abrupt shifts were made during the last 20 years. The two extreme reductions of about 10 percent in corn acreage (1944 to 1945 and 1949 to 1950) give a useful perspective in assessing the size of the reduction under the current feed-grain program.

The history of crop-acreage adjustments from previous years provides an index of the response to changes in a variety of kinds of expectations. Using the average of percentage increases from previous years as an upper limit on change and the average of percentage decreases as a lower limit, the 1960 planted acres were predicted on the assumption that farmers are motivated by profit maximization. The results agreed with actual plantings in direction of change from 1959, but overestimated corn and oats plantings and underestimated planted acres of soybeans and wheat.

The strong competitive position of corn in Illinois crop production is illustrated by varying the price expectation of corn through a wide range and noting the effect on planted acres. With 1959 prices expected for all other crops, an increase of corn price above its 1959 level would shift only a very minor amount of land to corn production. A drop of 20 cents in expected corn price would have decreased acreage about 7 percent under the conditions specified.

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CONTRIBUTORS TO THIS ISSUE

C. B. BAKER, Professor of Agricultural Economics, teaches agricultural finance and research methodology. He has numerous other writings on farm credit, including his Ph.D. thesis at the University of California. He is co-author of a recent Illinois Bulletin, "Effects of Borrowing From Commercial Lenders on Farm Organization."

HIROSHI NAKAMURA is a graduate assistant working toward a Ph.D. degree. Following graduation from Tokyo University of Foreign Studies, he worked for the Hohnen Oil Company of Japan. In 1960 he worked with a U. S. study group on the development of markets for agricultural products in Japan.

LOWELL E. WILSON received his Ph.D. degree from the University of Illinois in 1960. The article in this issue is a part of the research on his thesis, "An Analysis of Distribution Costs and Margins for Fluid Milk." At present he is a staff member of the Alabama Polytechnic Institute.

R. A. KELLY is Associate Professor of Fruit and Vegetable Marketing. He is in charge of the instruction in the introductory undergraduate course in agricultural economics and also teaches a course in his specialization — the economics of food distribution.

EARL R. SWANSON teaches a course in the economics of agricultural production. His research includes work in various farm-planning methods and analysis of the use of resources in agriculture. He spent 1958-59 in Denmark as a Fulbright Research Scholar.

UNIVERSITY OF ILLINOIS
AGRICULTURAL EXPERIMENT STATION
Urbana, Illinois
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LOUIS B. HOWARD, Director

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